SUBMARINE TELEGRAPHY—A NEW FRENCH TRANSATLANTIC CABLE.

By HENRY HAYNIE, in Boston Herald.

ANOTHER transatlantic cable is being laid from France to the United States, and very soon the French company will have two lines running under the ocean from the village of Orleans, Mass., on old Cape Cod to the city of Brest in ancient Brittany. It is not every one who can remember the earliest days of Atlantic telegraphy, that is to say, when a cable was laid from the shores of Newfoundland to the coast of Ireland, and when President Buchanan exchanged messages with Queen Victoria.

In 1879 the French republic, or rather M. Pouyer-Quertier and his friends, wanted an Atlantic cable to "secure the telegraphic independence of France," as another one, laid some time before from Brest, though undertaken on the principle of competition, had been absorbed by the Anglo-American. M. Pouyer-Quertier was minister of finance under President Thiers, and he played a prominent part in arranging for the indemnity of several billions of francs paid to Germany. Continental capitalists backed up the enterprise eagerly, but the English opposed it energetically. That French cable was landed first at St. Pierre, a matter of some 2,400 miles from Brest, and was thence continued for a distance of 850 miles more to the east shore of Cape Cod, in Eastham, and an office of transmission was established there. But two or three years back the station was moved to Orleans.

Some 1,223 separate and distinct cables, aggregating a total of nearly 185,000 miles, have been laid throughout the world in less than fifty years, at a cost of at least $165,000,000. However, we hardly ever think of the "thousand and one" submarine lines that cross coves, bays, estuaries, wide rivers, seas between islands, etc.; when we happen to speak of cables, we usually mean the great Atlantic system of telegraphy. Great Britain owns most of the great cables, operating fourteen long ocean cables, nine of which belong exclusively to her; in the Indias she owns ninety-three, and has a part ownership in five more; her home system includes 102 separate lines; and in her colonies there are forty-five, making a total of 260 cables. France operates sixty-five separate ocean cables, many of them the most important in existence. One of these is the French cable, as it is familiarly called, that has been working from old Brittany to old Cape Cod these eighteen years. Germany has forty-five cables, but they are short in comparison with those of England or France. Italy has thirty-eight. There are more cables in Sweden-Norway than in any other country, but they are all very short ones.

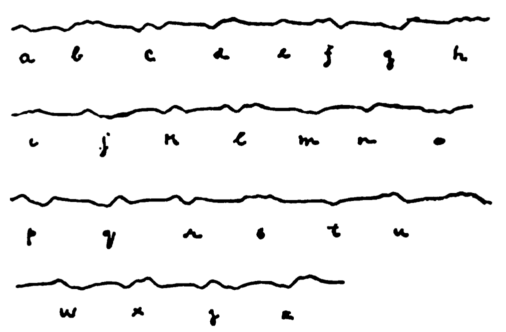
A new board of directors, under the management of M. Depelley, determined a short while back to improve the French Cable Company's facilities by reinforcing their old cable by another, and it is this new one which is now being laid. It is made up with the largest conductor ever yet laid to the United States, and it will be completed before the dead leaves finish falling. It will parallel the route of the old French cable, but so large are the dimensions of the core conveying the current that it is expected the message from France can be freely read off the siphon recorder here in Orleans without having to be written down and retransmitted at St. Pierre. The size of this coil is 700 or 800 pounds to the mile, independent of the gutta percha insulation, the manila covering and the further covering of large steel wires to protect it from material injury. To lay such a cable requires a steamer of extraordinary dimensions equipped with all kinds of electrical apparatus, as well as the most approved gearing and machinery. So the French company secured the steamship Silvertown. She is 350 feet long, 55 feet broad, 34 feet in depth, is fitted with engines of 1,800 I. H. P., and steams 10½ knots an hour, with a consumption of 30 tons of coal daily. She carries three tanks, each being 32 feet deep, and the largest is 53 feet in diameter. This tank has, consequently, over 70,000 cubic feet capacity.

When carrying 6,390 tons, the draught of the Silvertown is 28 feet. The coal bunkers have a capacity of 1,300 tons, besides which 1,000 tons of fuel can be stowed in the forehold. She has taken on board at one time as much as 2,160 knots of ocean cable. But a cable of the proportions now being laid down by the French company calls for three or four trips to complete the work. When the Silvertown pays out all the cable on board, her crew attach the end to a buoy and drop it overboard. Then she steams back to France, where the cable is made, takes on a further supply, returns to this buoy, takes up the end, makes a splice to it and so continues the work until the cable is entirely laid from Brest to Orleans.

The story of how a lost cable or a non-working one is picked up in midocean has been told repeatedly in newspapers and in magazines, but not so of the scene in a coast station where operators have to wait patiently and may be a long time for new connection with the office at the thither side of the Atlantic. The last important break in the French cable occurred last October, and it produced a delay of three weeks. "Day after day, night after night, through several weeks," said an operator to me, "one of us was always on duty watching and listening until sight and hearing were almost gone. Thrice every day and twice every night the wire was tested, not with any expectation of a message from our comrade on the steamer—it was not yet time for that—but simply to keep an accurate record of the condition of the cable. Sometimes wild messages seemed to be coming from the deep, extraordinary cablegrams in a language of gibberish that was wholly incoherent, but these were merely the results of magnetic storms and earth currents which reflected the galvanometer rapidly or jerked it to flash sentences that were nonsense. Then one morning at the end of three weeks the operator on duty observed a peculiar indication about the instrument which showed his experienced eye that a message was at hand, and in a few moments we were in communication with midocean."

The French Cable Company is represented in the United States by Mr. M. Lurienne, at New York, while the superintendent or manager of the Orleans station is Mr. H. Osborne, an Englishman, who learned how to telegraph when a mere boy in his first school days. The present writer is indebted to the latter for much valuable information. At the time of one of my visits to his office a cablegram from Father Neptune was received and handed to me. It is reproduced on this page precisely as it was traced by a curiously shaped glass pen worked by a delicate galvanometer on "the tape" or white paper string about three-quarters of an inch in width.

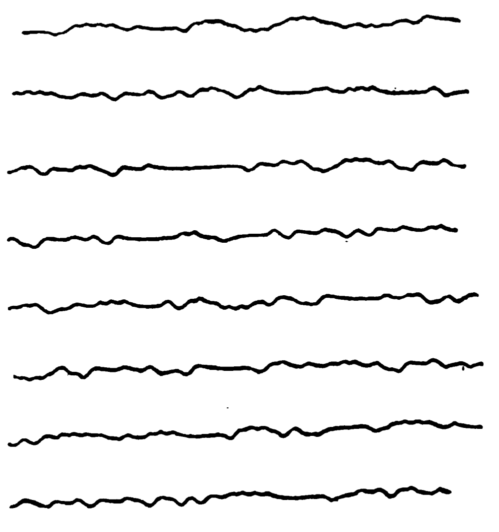
The cable men handle all the cable work, and there is a countercheck or record kept of all their work by the land wire men. The cable pen waves off a message, and above the line of curious looking ups and downs and curves which a delicately poised indicator traces stretches another line of words, but their lettering is broken into dots and dashes. This upper line is written by the Morse system of telegraphy, the lower or real cablegram is woven by a curiously shaped thing of hollow glass, through which flows a dark liquid, and the pen is caused to move or waver by the feeble electric current passing the galvanometer at the right hand of the operator. This instrument, the invention of Sir William Thomson (now Lord Kelvin), took the place of the much talked of and written of spark or flash telegraphy some time back.



THE SUBMARINE TELEGRAPH ALPHABET.

I do not know whether any of my readers have seen in practice that old fashioned mirror system of cabling, as it was called, by which they communicated formerly across the Atlantic. If they ever visit a cable station I strongly recommend them, as a matter of curiosity, to see it, if possible, for, though no longer in use, I dare say the manager will have it in storage somewhere about the office. It is one of the most ingenious pieces of machinery that I have ever beheld, even if it is obsolete. It involved this: The continual watching of a small speck of light reflected from a tiny mirror and traveling over a diagram representing words or letters of the alphabet or something of that sort. Naturally, the strain on the eyesight was immense; it was so great, in fact, that after some years' exercise of it a man became almost absolutely incapable of turning his attention to any other mode of earning his living.

Moreover, that system of forwarding messages was necessarily very slow, and called for two receiving persons, one to read the words, the other to write them down as called out to him. The companies, as well as the operators, were glad, therefore, when Sir William's invention enabled them to make use of the present system. If Morse signals could be sent by sound under the Atlantic, transmission of dispatches would be made more quickly and of course at less expense than is now the case. When the first submarine cable was laid under the ocean such sounds did work feebly through the line at the rate of about three words a minute, I believe, but that was altogether too slow, and was uncertain; so another method had to be invented. Thus came into existence what was known as mirror and flashlight system, just now spoken of. While it worked much more swiftly than the Morse, it could do no more than twelve to fifteen words a minute. This slowness impelled inventors to devise something else, and finally Sir William Thomson got up the present system, which is good for forty to forty-five words a minute. But attention is being constantly directed toward the utilization of sound signals by cable companies, and success will probably come eventually, though it is not yet in sight by any means.



FACSIMILE OF SUBMARINE CABLE MESSAGE.

Translation: "The Boston Herald is a great newspaper; it receives long European dispatches by the French telegraphic cables. We always read the Herald down here at the bottom of the Atlantic.—NEPTUNE."

Messages have been sent thousands on thousands of miles with wonderful swiftness. For instance, the London Globe of March 23, 1893, printed the following paragraph: "The result of the university boat race was telegraphed and received in New York three seconds after the result was known at Mortlake. This was accomplished by the French Atlantic Cable Company, and is one of the smartest telegraphic feats on record."

At the time of our presidential election in 1892 an English newspaper published in Kobe, Japan, wanted the result as soon as known in New York, and the editor arranged by correspondence with the manager in America of the French cable to forward the same as swiftly as possible. I may say that when it is midnight in New York it is only 2:15 o'clock of an afternoon at Kobe. Well, at midnight of the day of election these four words: "Herald, Kobe, Japan, Cleveland," were started from the office in Gotham. They went to Cape Cod, thence to St. Pierre, thence to Brest, thence to Paris, thence across the continent of Europe, under the Mediterranean to Africa, under the Red Sea to Asia, then through India and China, under the Sea of China to Yokohama, from which place they were telegraphed by land wires to Kobe, where they were handed to the editor, who at once put the Herald with the important news to press, and an "extra" was selling in the streets of Kobe at 4:30 o'clock. Precisely two hours and fifteen minutes had elapsed since that dispatch left New York, and I daresay as much time was consumed in getting it from Yokohama to Kobe, setting it up in type, and printing it as there was in transmitting it from the United States to Japan.

It is not so very far from here to Boston, straightaway, but as yet cablegrams from Europe addressed to your city are not sent directly there. In the summer of 1895, while in Portland, Me., I had occasion to send a telegram to Bar Harbor, some distance to the eastnortheast from that place. When the message was handed in and paid for, the gossiping clerk said it would have to be sent to Boston first before it started on its way to Bar Harbor. This, I thought then, was quite a "roundabout way" of reaching that resort; but it was a mere nothing as compared with the flight of a telegram from Orleans to Boston. All messages from Europe are distributed only from the New York office, so I was informed at the cable station. It is the intention to open a cable office in Boston soon, and before this is done a land wire will be constructed from this village to the capital of the commonwealth; meanwhile all dispatches must go to the metropolis. We will suppose that Ambassador Porter wants to communicate with the editor of the Boston Herald. He files his message in one of the many telegraph bureaus that are scattered over Paris, and it starts on its long voyage straightaway to America. The course is due westward to the island of St. Pierre-et-Miquelon, off Newfoundland—owned by the French republic; but thence the submarine cable runs southerly to Cape Cod and finally reaches Orleans, about 65 miles from Boston in a direct course. Received there and recorded, the diplomatic communication to our fourth estate is not, however, sent directly on to its destination. Instead, it takes its way the whole length of Cape Cod to the mainland of Massachusetts, goes out of that State into Rhode Island; out of that and into Connecticut; thence into New York State beyond Stamford, and, by and by, reaches the island of Manhattan, where another record and transfer are made of the message. This done, it is "rushed" toward Boston. Again it travels in four States, and finally, after having been flashed along something like 500 miles of land wire since it came ashore at Orleans, it reaches its destination in the Boston Herald building.

This "circumlocution" and its attendant delay, not to mention the annoyance of being thus compelled to be subordinate to Gotham, will disappear altogether when the French company opens its Boston office, and enters into competition with the Commercial, the Western Union, the Anglo-American, the Direct and all the other lines. For though the rates are precisely the same on all of them from Boston to Paris or to London, there is competitive rivalry, and business is keenly sought for by each company. Said the manager:

"Though I cannot reveal to you any details in the commercial transactions of this company, I may state that our traffic has not materially suffered from the recent business depression, and I think we have had a fair share of the messages between America and Europe, both ways. Our precise percentage of the entire traffic as compared with the percentage of it which the Anglo or some other company secured is an office secret, but I repeat we have no reason to complain; quite the contrary, in fact. When the new cable is down, when we have our own office in Boston, and a land wire thence to this station, our share of the whole will be considerably increased, while the public and the press will have a much better service than ever."

The first charge for messages through the Atlantic cable, from New York to London, or vice versa, was $100 for 20 words: this rate was reduced after some time to $50 for 10 words, and by 1875 the tariff had got down to $1 a word. A new company completed a cable in 1875, and then a rate of 75 cents a word was established. The French Cable Company—Le Compagnie Francaise du Telegraphe de Paris à New York—landed its cable on the shore of Cape Cod in 1879, and effected a reduction of tariff to 50 cents; it is now 25 cents a word to either London or Paris.

But the cost of cabling a dispatch to some place in Japan or China, or, indeed, to any country on the western coast of the Pacific Ocean, would be very great. The message would have to be sent over 3,000 miles due east before it could commence feeling its way toward Japan or Australia. Such a dispatch sent from San Francisco would have to cross the American continent, the Atlantic Ocean, Europe, a part of Africa, and all of Asia, together with numerous intermediate seas and other oceans before it reached Yokohama or Melbourne. The cost per word would be as much as $2.85 to Auckland, or $2.35 to the capital of Japan.

THE MASSENA WATER POWER ELECTRICAL GENERATING PLANT.

IN our issue for August, says the American Electrician, announcement was made for the commencement of work on the canal of the St. Lawrence Power Company at Massena, N. Y., and we are now enabled to

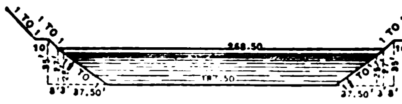


FIG. 1.—SECTION OF CANAL.

give an account of some of the more important features of this great undertaking, which involves the immediate utilization of 75,000 horse power, with a prospective utilization of 150,000 horse power.

Fig. 5 is a map showing the location of the plant and canal and Fig. 1 is a section of the latter. The St. Lawrence River has a fall of more than 50 feet over the Long Sault rapids between the mouth of the canal and the point where a small stream—the Grass River—flows into the St. Lawrence. The canal will connect the St. Lawrence with the Grass River at a point of the latter where the water will have a fall to its bed of 47 feet, of

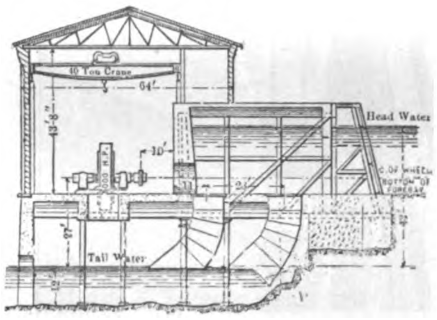


FIG. 2.—SECTION OF POWER HOUSE.

which there will be available at the turbines an effective head of over 40 feet.

The power house will be built on the bed of Grass River below the canal outlet, and will be 600 feet long by 130 feet wide. Fig. 4 shows a plan of the power house and Fig. 2 a transverse section. The turbines will be of the horizontal shaft type, two to each shaft and each pair developing 5,300 horse power. Fig. 3 shows the setting of the pairs and the draught tubes.

The turbine shafts, which are 80 feet long, will extend through a wall separating the canal or turbine chamber and the power house. Each shaft will have mounted

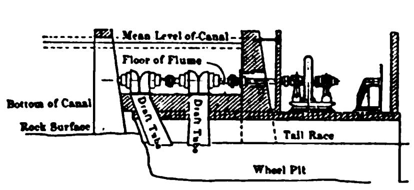


FIG. 3.—ARRANGEMENT OF DYNAMOS AND TURBINES.

on it a great ring of steel, which will carry on its circumference twenty external pole pieces, the ring and pole pieces being of one solid casting of steel. The former will have an extreme diameter of 15 feet and be about 3 feet wide and supported by a massive hub having ten radial arms or spokes. Each of the machines will weigh 350,000 pounds, stand 22 feet high above the top of the foundation and occupy a floor space of 22 feet by 18 feet.

The stationary part of the dynamo will form the armature and will consist of a large ring or cylinder, the inner surface of which will be made up of plates of soft, thin steel on edge held by the massive outer ring of cast iron. The inner surface of the steel plates will have slots in which will be laid copper bars parallel with the shaft of machine, insulated from each other with mica and in which will be generated the three-phased currents.

The poles of the revolving portion or field of the machine will be wound with copper ribbon. The speed will be 180 r. p. m. and the current will be generated at ...quency of 30 periods per second.

...e owners of the St. Lawrence Power Company are M...s. Stewart & Company, 40 Wall Street, New York. ...ngineer is Mr. John Bogart, formerly New York ...ngineer.

...racts for construction of the plant have been let as follows: For excavating the canal, building the power house and hydraulic work, to the Lehigh Construction Company, Limited, of South Bethlehem, Pa.; the fifteen 5,000 horse power generators will be furnished by the Westinghouse Electric and Manufacturing Company; and the turbines by the Stilwell-Bierce & Smith-Vaile Company, of Dayton, O. Seventy-five thousand horse power electrical energy are to be available before the end of next year.—American Electrician.

THE MAGNETIC DIP OF ANCIENT TERRA-COTTAS.

THE article on this subject contributed by the Cavaliere Giacomo Boni to the Journal of the Royal Institution of British Architects, June 17, 1897, is of great importance, says the Builder. Dr. Folgheraiter's experiments have proved that clay cylinders acquire during the period of cooling after being baked a permanent magnetism, owing to induction by the earth's magnetic field. If we know the position in which a terra-cotta vase, for example, has been baked and determine the direction of the field of its remanent magnetism, then we know the "dip" of the earth's magnetic field at the period at which the vase was baked. If we know the "dip," then, as it is always slowly changing, it will be a great help in fixing the date of the vase. Conversely, if we know the date of the baking and the position in which it was baked, then we can find the "dip" at that period. Prior to 1576 we have no records of the magnetic "dip." Since that date it attained a maximum value of 74° 42′ in 1720, and then gradually diminished to its present value of 67° 30′. Dr. Folgheraiter found that four terra-cotta cistae of about the eighth century B. C. show distinct traces of south polarity about their bases, which is strong evidence that at the time and place where these vases were baked a magnetic needle would have dipped toward the South Pole. The Cavaliere Giacomo Boni points out the necessity of further experiments in this direction. He suggests that brick walls which have been subjected to fire at a known date, e. g., the great council hall of the ducal palace in Venice, burnt A. D. 1575, should be examined for traces of remanent magnetism. If we can thus determine approximately the "dip" at the period of the fire, it will be an obvious example of the value of the method. A more promising suggestion is to examine magnetically volcanic rocks due to eruptions of historical date. At Herculaneum, for example, there must be plenty of strongly magnetic substances which came in contact with the lava, by examining which the magnetic dip at the date of the eruption might be ascertained.

Members of the Royal Institution of British Architects are asked to give notice of any buildings they may happen to come across which exhibit traces of magnetism induced at some former period. In a note Dr. Folgheraiter's method is described, presumably for their instruction. It is very difficult for any one but an expert on laboratory methods to understand it. It is of no great use, except as a laboratory method of determining the magnetism of something like a vase uniformly magnetized. The mysterious "areotg." mentioned is a misprint for "arctg.," or, as we write it in England, tan' From experiments of our own on a block of asbestos, afterward found to contain traces of magnetite, we found that it was very irregularly magnetized; the lines of force seemed to radiate in all directions through the body. Baked clay, we imagine, contains considerably less than ten per cent. of the ferrous ferric oxide, which constitutes its magnetic substance; it will, therefore, be a very feebly magnetic body, and it will be very difficult to determine the direction of its remanent magnetism, especially if it is not uniform.

Electricians can determine to within one per cent. the strength of the current in an electric cable by means of a little compass, such as is often worn as a "charm" on a watch chain. Architects often use such a compass to determine the position of an iron girder or a gas pipe. A sensitive compass on this principle might be employed to detect whether there is anything abnormal in the magnetic field in the neighborhood of an old building or a monument. An expert could then find out the cause of this, and, if possible, determine the direction of the feeble remanent magnetism. It is highly probable that some curious instances of magnetic effects might be discovered by this means, if several people systematically experimented with this end in view. At any rate, speaking from experience, we can say that it is no waste of time to learn how to use a charm compass scientifically.

A NOTE ON SOME OF THE REQUIREMENTS FOR A SANITARY MILK SUPPLY.*

By WILLIAM T. SEDGWICK, Ph.D.

IT is now generally recognized that the milk supply problem is one of the most pressing in American sanitation, and I am frequently asked to give an opinion as to the merits of this or that remedial measure. I have therefore thought it worth while to lay down very briefly, but I hope clearly, the fundamental principles which must be carefully kept in mind in seeking to introduce sanitary reforms into this important industry.

The fundamental, indispensable and all-controlling requirement of a sanitary milk supply is that milk, when consumed, shall be as nearly normal as possible. Normal milk is milk as it flows from the mammary gland of a normal animal, and a normal animal is obviously one that is healthy and well fed. From such an animal under normal conditions the milk supply of its young passes almost instantaneously, and without exposure to dust and air, from the milk ducts of the mother to the stomach of the suckling. Such milk is absolutely fresh, warm and free from dirt. It is not only undecomposed, but nearly or quite free from the germs (bacteria) of decomposition.

Ordinary city milk, on the contrary, is neither fresh, warm, nor free from dirt, and if not already far on the road toward decomposition, is always richly seeded with bacteria. It is not always derived from healthy or well-fed animals, and is seldom drawn under clean and sanitary conditions, so that even at the outset it may be, and often is, very far from normal. It is also too often transported over long distances, so that it still further loses its original freshness, and it is frequently manipulated by unclean, and sometimes by diseased, workmen. By the time it reaches the consumer, therefore, it is not only no longer normal milk, but usually stale, dirty, more or less decomposed, and sometimes also diseased.

Some of the steps to be taken in securing a more sanitary supply are easily deduced from the foregoing facts, and are as follows:

1. Milch cows should be healthy, well fed, well kept and well cared for.

2. Milk should be derived from such cows only, and with all possible precautions in regard to sanitation

* From the Technology Quarterly of the Massachusetts Institute of Technology.

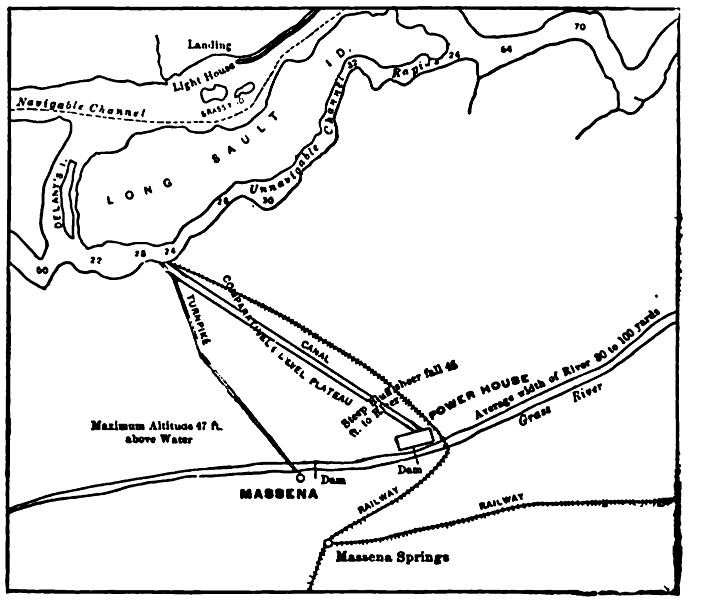


FIG. 5.—MAP SHOWING LOCATION OF CANAL AND PLANT.

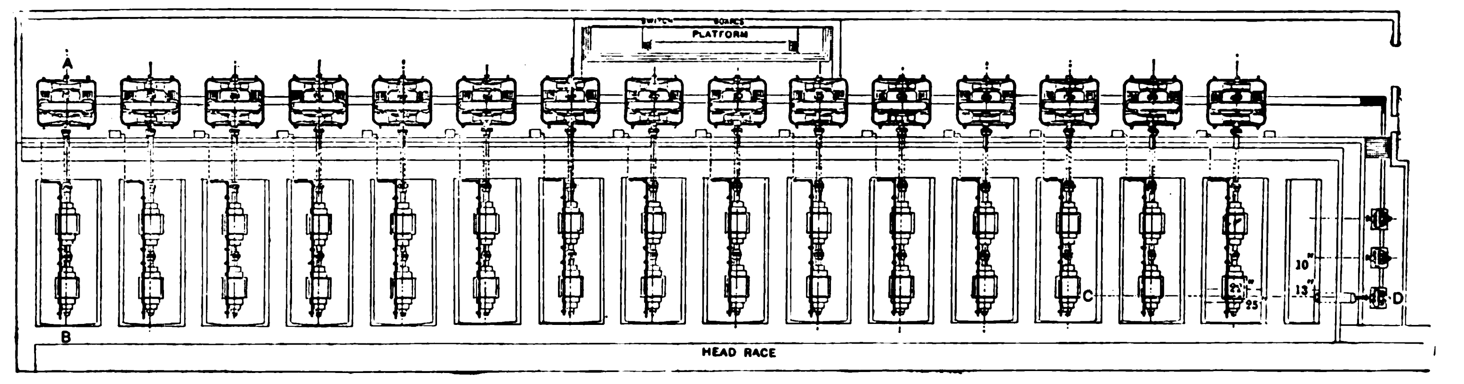


FIG. 4.—PLAN OF POWER HOUSE.